

REMARKS

This is in complete response to the Official Action of November 26, 2010.

Claims 1 and 3-39 are pending in the application. Of those, claims 15-38 have been withdrawn from consideration as pertaining to a non-elected invention. Claims 1, 3-14 and 39 are under examination, and stand rejected. Applicants hereby request further examination, reconsideration, and withdrawal of all outstanding rejections.

The lead independent claim, claim 1, has been amended to more particularly point out and distinctly claim the invention. Among other things, claim 1 has been amended to eliminate a product-by-process limitation, i.e., that "the dissymmetric particle is produced by bringing into contact the first part having coupling agents attached thereto with a precursor of the second part in a solvent, and by controlling the concentration and the size of the first part in the solvent so that the ratio between the number of said first parts in the solvent and the number of said second parts to be formed in the solvent is close to 1." It is Applicants' intention to claim the resulting product irrespective of the manner in which it is obtained. In order to more clearly claim the subject matter perceived by the Applicants' to be their invention, that clause has been removed and replaced with the following: "the coupling agent is a methacryloylalkyltrialkoxysilane, or a macromonomer of the group consisting of hydroxycelluloses, polyvinylpyrrolidones, polyacrylic acids, and poly(polyvinyl) alcohols." In this manner, Applicants have clearly recited the involvement of a coupling agent, and specifies coupling agents that are expressly set forth within the specification, e.g., p. 6, l. 26-36; and at p. 7, lines 25-35, and in original claims 21 and 24. Thus, no new matter has been added.

The various clauses of the claim have been re-arranged to more clearly recite the intended invention; and to recite that the particles are those wherein there is a singular first part, a singular second part, and the two parts are conjoined by coupling agent bound to the surface of the first part. As those amendments are substantially a re-arrangement of existing clauses, Applicants submit that those amendments likewise do not introduce new matter.

The claim, as amended, recites:

A dissymmetric particle of nanometric or mesoscopic size consisting of a first part, a second part, and a coupling agent, wherein:

- the first part consists of a single particle of an inorganic material A of a mineral oxide or a metal, of between 50 and 250 nm, and having an outer surface to which is adsorbed or covalently grafted the coupling agent;
- the second part consists of a single substantially spherical nodule of an organic material B of a polymer of recurrent vinyl units, having an outer surface coupled to an outer surface of the first part by the coupling agent;

and wherein the coupling agent is a methacryloylalkyltrialkoxysilane, or a macromonomer of the group consisting of hydroxycelluloses, polyvinylpyrrolidones, polyacrylic acids, and poly(polyvinyl) alcohols.

The amendment also clarifies Applicants' intention that the claimed particles be those wherein there is a one-to-one correspondence in first part to second part. This is supported throughout the specification. *See, e.g.*, page 3, line 33 - page 4, line 6; page 5, lines 30-34; page 11, lines 11-21; page 16, line 10 - page 17, line 1; page 17, lines 16-22; page 17, lines 31-33; and Figures 1-6. Thus, the limitation that the particles consist of only a singular first part and only a singular second part conjoined by a coupling agent likewise does not constitute new matter.

Section 112 Issues:

All claims under examination have been rejected under §112, first paragraph, as failing to comply with the written description requirement. The rejection asserts that the claims contain subject matter not described in the specification. Without conceding the point, Applicants submit that the amendment submitted herewith moots that rejection. Reconsideration and withdrawal of the rejection is respectfully requested.

The rejection further asserts that the added limitation wherein the concentration ratio of the first parts to the second parts is close to 1 in the solvent of the reaction mixture, is not disclosed in the specification. Without conceding the point, Applicants have removed that limitation. Accordingly, the rejection is mooted. Reconsideration and withdrawal of the rejection is respectfully requested.

Applicants have modified the independent claim, however, to recite that the particles themselves consist of only a singular first part and a singular second part conjoined by a coupling agent. As shown above, that limitation is fully supported by the specification, particularly the discussion and description of the Figures as found in the Examples section, *i.e.*, pages 16-17 and corresponding Figures.

Prior Art Issues:

The rejection asserts that all claims under examination would have been obvious over Xia et al. (JACS, 123, 771-772), in view of Reculusa (*Chem. Mater.*, 14, 2354-2359) and further in view of Yadav (US2003/102099). The rejection asserts that the combination of Xia and Reculusa substantially discloses the claimed invention, but acknowledges that the combination fails to disclose particles in the

range of 50 - 250 nm. The rejection asserts that Yadav discloses nano-dispersed powders used in paints and catalyst supports having carrier particles of silica, and having a dispersed particle attached to the carrier particle, and that those powders are less than 100 nm in size. The rejection alleges that it would have been obvious to one of ordinary skill in the art to modify the size of the particles disclosed by Xia and Reculusa to less than 100 nm as taught by Yadav. Applicants respectfully traverse the rejection.

The rejection gives the cited references more than they're due. The rejection improperly combines two fundamentally distinct methods, and asserts that it would have been obvious to combine techniques and reagents from one or the other to arrive at the claimed invention. The references, however, fail to teach or suggest the claimed invention in a manner that one of ordinary skill in the art would have had a well-reasoned expectation of success in arriving at the claimed dissymmetric particles, much less which of the various techniques and reagents could or should be combined to do so. Accordingly, the references fail to teach or suggest the claimed invention.

The rejection asserts that Xia and Reculusa, in combination, teach the means for joining a polystyrene nodule and silica colloid. The rejection acknowledges the deficiency of Xia in that it teaches joining the particles by application of heat alone. It is asserted, however, that Reculusa discloses that the silica surface can be modified to allow anchoring of polymers, and that this has been done by grafting alkoxy silane to the silica surface. Further, the rejection asserts that alkoxy silane modification can be considered a "coupling agent."

The combination of Xia and Reculusa, however, would not have taught or suggested the claimed invention. Xia relies on a physical entrapment of the polystyrene bead within a 2D array of holes in a glass substrate. Xia at 771, col. 2 ("The *key strategy* of this assembly approach is the dewetting of an aqueous dispersion of spherical colloids that has been confined within a parallel cell composed of two glass substrates. The surface of the bottom substrate has been patterned with a 2D array of cylindrical holes." (emphasis added)). The array is configured such that "only one single polystyrene bead could be retained in each cylindrical hole." *Id.* The polystyrene bead is then fixed in the hole by welding it to the walls of the hole by heating above the glass transition temperature of styrene. Xia, p. 771, col. 2. Thus, the polystyrene bead is welded into the hole by heat.

A second spherical colloid could then be added into the remaining void space in the cylindrical hole; and that second colloid could then be welded to the first also by heat. Xia, p. 772, col. 1, l. 4-7 ("Once formed, the two particles in each hole could be permanently welded into a single piece by heating the sample to a temperature slightly higher than the glass transition temperature of polystyrene. Thus, the polystyrene of the first colloid is itself used as a "coupling agent" or fixative between the colloid and the wall of the hole, and between the first and second colloid. One skilled in the art would immediately appreciate that such manipulation, and repeated heating and melting, would result in irregularities in the shape of the first (polymeric) colloid, with corresponding loss of spherical shape. Thus, the polymer colloid of Xia is not bound to the surface of the inorganic colloid by a coupling agent, and furthermore has undoubtedly compromised its spherical shape.

Xia further explains that another "critical" aspect of the process is the size of the holes. Xia, p. 771, col. 2 ("The *key* to this process is to control the ratio between the dimensions of the holes and the diameters of the colloidal particles to ensure that only one colloidal particle could be added into the hole in each step." (emphasis added)). The outcome of such a *key* process limitation, however, is that the size of the respective particles are constrained by the manner in which the particles are made. Xia explains that the particles must be of fundamentally different size, and the second inorganic colloid must be substantially smaller than the first polymeric colloid to avoid the formation of homogeneous dimers of the polystyrene bead. Xia, p. 772, col. 2, lines 3-5; *see also* Figs. 1 & 2. Thus, one of ordinary skill in the art would immediately appreciate that, were it not for the physical entrapment of the particles in the holes, and the essential limitation on the use of the different sized particles, the method would produce homogeneous dimers and/or particles not having the required distribution of first part and second part required by the instant claims.

Further, and as acknowledged, the resulting particles would not have the requisite coupling agent.

Reculusa does not cure the deficiencies of Xia. Rather, Reculusa is directed to such a fundamentally different objective and approach that it must be considered non-analogous art. Reculusa is expressly devoted to producing particles fundamentally distinct from those of the instant claims, i.e., raspberry-like particles. Reculusa, p. 2355, col. 1 ("... we aim to report new results along these lines on the synthesis of raspberry-like silica/polystyrene particles in emulsion polymerization."); *see also* Fig. 3. Thus, where Xia goes to great lengths to structure a process that

precludes the formation of homogeneous dimers and particles of more than two parts, Reculusa is devoted to precisely the opposite, i.e., the formation of raspberry-like structures having a uniform layer of a multitude of second particles over the entire surface of the first particles.

Unlike the particles of Xia, the Reculusa particles are deliberately fabricated to have a multitude of smaller polystyrene colloids (formed *in situ*) on the surface of an individual, larger silica particle. Thus, where Xia describes the use of a singular larger *polystyrene* bead to which is attached only a singular smaller *inorganic* bead; Reculusa describes the formation of a raspberry-like structure wherein the surface of the central larger *inorganic* bead is coated with a multitude of smaller *polystyrene* beads. Thus, as between the two, the structure and orientation of the two particles is distinct, as is the ratio of discrete colloids found within the respective particles.

Aside from the differing structures, Reculusa likewise fails to teach or suggest the specific coupling compounds found here.

To the extent that the coupling agents of Reculusa have any similarity to those of the instant claims, Reculusa teaches away. Reculusa teaches that the described reagents produced a particle wherein an inorganic colloid is coated with a multitude of polystyrene colloids. One reading Reculusa would have understood that the reagents of Reculusa produce a structure fundamentally different from those recited in the instant claims.

Specifically, Reculusa teaches that the disclosed method and disclosed reagents produce particles having a multitude of binding sites, to which great numbers of the growing polystyrene particles will bind. Reculusa, p. 2355, col. 1 ("The second stage is crucial and involves the adsorption of a macromonomer, i.e., a

macromolecule with a polymerizable group, poly(ethylene glycol) monomethyl ether methacrylate, *which is expected to react with the growing polystyryl radicals and thus promotes anchoring of the polymer chains on the silica surface.*" (emphasis added)).

Reculusa's reference to the *criticality* of this step, and to the fact that the reagent binds to a plurality of polystyryl radicals, would have led one to expect that such methods and reagents would produce particles having multiple sites of adhesion, and thereby give rise to precisely the type of particle Reculusa reports, *i.e.*, raspberry-like particles.

One of ordinary skill in the art reading Reculusa would have understood from that teaching that those reagents produce particles having a multitude of parts, assembled in a raspberry-like structure. One seeking to make the particles of the instant claims - having only a singular first part and a singular second part, conjoined by a coupling agent - would have been dissuaded by the teaching of Reculusa as it would have been expected they would produce particles having a plurality of parts substantially beyond the singular first and second parts of the instant claims.

One would have been further dissuaded by Reculusa in that it noted that other, purportedly analogous, methods produced similar multi-component particles,

i.e., organic-inorganic particles having a core-shell structure. Reculusa, p. 2355, col.

1. One of ordinary skill in the art would have likewise appreciated that such a structure is fundamentally different, and squarely at odds with the claimed particles.

As such, one would have been motivated to avoid the methods and reagents of Reculusa.

Reculusa's reagents would have been expected to produce multi-component particles wherein numerous polymeric colloids would bind to numerous sites on the

coated surface of the inorganic colloid, thus producing a structure fundamentally different than the claimed single first part and single second part conjoined by a coupling agent.

Further, the *in situ* formation of the polystyrene of the Reculusa reference is fundamentally incompatible with the method of Xia, which requires the use of particles of known and definite size so as to limit the capacity of the hole to only one organic particle and only one smaller inorganic particle. The *in situ* formation of polystyrene used by Reculusa would permit the introduction of multiple polystyrene particles within the confines of the hole at least until the polystyrene particles have grown to a size that they would be excluded from the hole. Even so, one skilled in the art would expect from the Reculusa reference that multiple polystyrene particles would still adhere to the exposed surface of the silica colloid.

Moreover, one skilled in the art would expect that the requisite inversion of order of addition of the two methods make them fundamentally incompatible, and thus would not produce the claimed particles. Xia requires the polystyrene particles be introduced first, and then immobilized by melting, thereby welding the particle to the plate; after which, the silica particle is added, and welded to the polystyrene particle again by melting. In contrast, Reculusa requires first the treatment of the silica particle with an adhesion agent, followed by *in situ* formation of the polystyrene. Thus, for example, if one were to combine the adhesion method of Reculusa with the method of Xia, the *key* step according to Xia could not be accommodated (*i.e.*, "to control the ratio between the dimensions of the holes and the diameters of the colloidal particles to ensure that only one colloidal particle could be added into the hole in each step.").

If, however, the coated silica particles of Reculusa were added to the entrapment method of Xia, the multiple bonding sites of that method would not restrict the product to one-to-one correspondence of parts as the method exposes numerous potential points of attachment between the silica bead and the polystyrene bead, e.g., outside of the hole. Thus, the method's *key* process step would be ineffective because the coated silica beads would be expected to attach to all exposed surfaces of the polystyrene bead as taught by Reculusa. One of ordinary skill in the art would not have had a well reasoned expectation that such a combination would produce the particles of the instant claims, i.e., having one-to-one correspondence of first part and second part. In other words, entrapment within the hole would not be the ratio limiting step as it would be in Xia since any exposed surface would be subject to binding.

The foregoing shows that the combination of Xia and Reculusa does not teach or suggest particles of the claimed structure and size. Yadav is cited as purportedly showing particles of the claimed size. However, the rejection does not assert that the particles of Yadav have the claimed structure; and so the rejection relies upon the asserted combination of Xia and Reculusa. As shown above, however, Xia and Reculusa do not teach or suggest particles of the claimed structure. Thus, Yadav does not cure the deficiencies of the combination of Xia and Reculusa, and so the rejection fails to make a *prima facie* case of obviousness.

Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that the claims are in condition for allowance. Further examination,

reconsideration, and withdrawal of all outstanding rejections is respectfully requested in favor of a formal notification of allowance. If the Examiner perceives any impediments to such notification, whether of a substantive or formal nature, the Examiner is encouraged to telephone Applicants' representative at the number provided below. Such informal communication will expedite resolution, and disposal of the instant case.

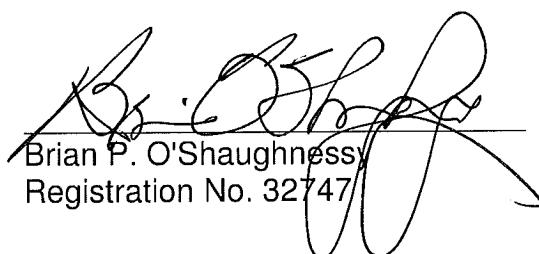
The Director is hereby authorized to charge any appropriate fees under 37 C.F.R. §§ 1.16, 1.17 and 1.20(d) and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

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By:



Brian P. O'Shaughnessy
Registration No. 32747

Customer No. 21839
703 836 6620